APPENDIX 19-1

SECONDARY BENEFIT ALTERNATIVES / ADDITIONAL FEATURES TECHNICAL MEMORANDUM

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TECHNICAL MEMORANDUM

South Florida Water Management District — B&V Project 141731
EAA Reservoir A-1 — B&V File:
Work Order No. 10 — First Issue: July 13, 2005
Last Updated: July 22, 2005

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TABLE OF CONTENTS

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From: Pam Kenel and Mark Driscoll

1. PROJECT INFORMATION

1.1 Introduction

This Technical Memorandum is intended to assess the options for secondary benefits of the EAA Reservoir A-1 Project. The information in this memorandum is provided as part of Task 7.1.4.1 – Evaluate Secondary Benefit Options.

The Everglades Agricultural Area (EAA) Storage Reservoirs, Phase I Project includes two above ground reservoirs with a total storage capacity of approximately 240,000 acre-ft located on land associated with the Talisman Land acquisition in the EAA. Conveyance capacity increases for the Miami, North New River (NNR), Bolles and Cross canals are also included in the design of this project. The initial design for the reservoir(s) assumed 40,000 acres, divided into two equally sized compartments with water levels fluctuating up to six-ft above grade in each compartment. However, actual design and construction of this first phase may result in multiple reservoirs by maximizing the use of the land acquired through the Farm Bill land acquisition agreements which encompasses up to 50,000 acres (USACE and SFWMD, 2002). As part of the current design plans for the reservoir, a seepage canal will be constructed around the perimeter of the reservoir. The engineering specifications for this seepage canal have not yet been finalized.

In October 2003, the South Florida Water Management District (District) decided to pursue a "Dual Track" for Phase I of the EAA Storage Reservoirs Project. While the multi-agency Project Delivery Team, led by the U.S. Army Corps of Engineers, continues to develop the Project Implementation Report (PIR), the District is proceeding with the design of a reservoir, designated EAA Reservoir A-1 Project, located on land acquired through the Talisman exchange in the EAA. The EAA Reservoir A-1 Project is located in Palm Beach County with a total storage capacity of approximately 190,000 acre-ft with a maximum storage depth of approximately 12-ft (CERP, 2005).

1.2 Purpose of EAA Storage Reservoirs, Phase I

The purpose of the EAA Storage Reservoirs, Phase I Project as defined in the Comprehensive Everglades Restoration Plan (CERP), is to improve timing of hydrological deliveries to the Water Conservation Areas by reducing damaging flood releases from the EAA to the Water Conservation Areas, reducing Lake Okeechobee regulatory releases to estuaries, meeting

supplemental agricultural irrigation demands, and increasing flood protection within the EAA. The EAA Storage Reservoirs, Phase I Project Management Plan defines the goals and objectives of the project as follows (USACE and SFWMD, 2002):

- Reduction of the Lake Okeechobee regulatory releases to the estuaries and back pumping from the EAA into Lake Okeechobee by sending the water to the south and into the reservoirs
- Improved environmental releases through the storage of water and release to the Everglades during the dry season demand
- Flow equalization and optimization of treatment performance of STA-2, STA-3/4, STA-5, and STA-6 by capturing peak storm event discharges within the reservoirs for slow release to the STAs
- Improved flood control and regional water supply for the agricultural community currently served by the EAA canals and other areas served by Lake Okeechobee

According to the CERP Guidance Memorandum, the proposed project should be designed to minimize negative impacts on existing public use and recreation and attempt to provide new public use and recreation opportunities where practicable.

1.3 Scope Of Additional Features Technical Memorandum

This Technical Memorandum is intended to assess the options for secondary benefits of the EAA Reservoir A-1 Project. The information in this report is provided as part of Task 7.1.4.1 – Evaluate Secondary Benefit Options. Existing data has been reviewed to determine possible secondary benefits of the project. More detailed assessments of secondary benefits and costs benefit analysis may be conducted, as needed, at later stages of this continuing project.

At this point in the project two major secondary benefits have been identified:

- Aquatic Habitat Creation and Enhancement
- Creation of recreational opportunities

These secondary benefits are discussed further in the following sections.

2. HABITAT CREATION AND ENHANCEMENT

Enhancement of ecological values is a desirable feature of the project that is supported and promoted by the Fish and Wildlife Service. Opportunities to provide benefits for fish and wildlife resources can be incorporated into the reservoir and seepage canal design in a number of ways that are described here.

Aquatic habitat creation will result from the construction of the reservoir on what are currently uplands and wetlands on the project site, thereby increasing the spatial extent of natural areas.

Uplands and most of the wetlands on site are providing habitat of limited value to wildlife due to the impacts of extensive agricultural activity.

The constructed reservoir will provide aquatic habitat that can be utilized by icthyofauna, benthic invertebrates, amphibians, reptiles, mammals, and birds. Additional areas for deep water refugia can be incorporated into the design. Construction of seepage canals surrounding the reservoir will provide additional aquatic habitat of improved functional quality. Along Highway 27 provision of habitat buffers using up to 150-ft wide linear strip of land between the seepage canal and the toe of reservoir embankment and the up to 50-ft wide linear strip between the seepage canal and the property line is planned. Littoral shelves are planned to be placed intermittently along the seepage canals to provide enhancements to the fish and wildlife habitat of the site. The construction of the reservoir will remove the existing agricultural fields and conveyances of agricultural run off, thus reducing nutrient loading downstream and further enhancing the quality of the aquatic habitat.

Aquatic habitat quality is dependent on the quality of water, quantity of water, velocity of water, and physical cover (Seaman, 1985). Water levels and flow velocity will be optimized by the project, as described in Section 1.2 of this report. It is recognized that the purpose and operations of the project will require fluctuation in water levels. However, minimum levels will be set to ensure sustainability of the aquatic habitat features while ensuring that the project's primary function is not diminished. Additionally, it is noted that some fluctuation in levels can be beneficial to promotion of vegetation species diversity.

It is anticipated that the construction of the seepage canals would involve the natural establishment of desirable vegetative cover, improved water quality, and creation of additional substrates such as snags, natural banks and rock shoals. The project design will incorporate constructed littoral benches intermittently along the seepage canal. Adjacent to the canals and reservoir are linear areas that may provide additional natural habitat buffers. Below is a discussion of each of these benefits.

2.1 Physical Cover

According to the *Florida Aquatic Habitats and Fisheries Resource* (Seaman, Jr., 1985) fish and other aquatic organism production increases with the increase in physical cover. Cover types include holes, roots, aquatic vegetation, and overhanging vegetation. Adjacent floodplain wetlands can also provide important cover during flood events. Given favorable substrate and chemical conditions, waterbodies that harbor the greatest amount of physical cover will also harbor the greatest production of fish species (Seaman, 1985).

Depending on the final construction design for the EAA Reservoir and the associated seepage canal, it can be assumed that a variety of physical cover elements will result from associated project activities and natural processes. Rock and soil from the side walls can be expected to accumulate in both the reservoir and seepage canal during construction. This accumulation of sediments will provide habitat diversity along the base of the structures, providing valuable

habitat to a variety of organisms. Additionally, over time, vegetation from planting and/or natural colonization will provide organic cover elements in the form of aquatic vegetation and overhanging vegetation.

2.2 Water Quality

Water quality is affected by many sources including run-off from urban and agricultural areas that can contribute multiple contaminants to surface waters. Within the project area, agricultural run-off is the main contributor to water pollution and has resulted in high loads of phosphorus detected in the surface waters (SFWMD, 1999). When nutrients such as nitrogen and phosphorus accumulate in an aquatic system, algal blooms may occur which, in turn results in a loss of rooted native aquatic vegetation, a buildup of organic sediments, and a subsequent loss of fish spawning and nursery areas (FWC, 2005b). However, there are many other water quality parameters that affect aquatic ecosystems, including dissolved organic carbon, dissolved oxygen, methylmercury, organochlorines, nitrogen, sulfate, pH, specific conductivity, chlorophyll, and water clarity.

It is not expected that any specific measures will have to be taken during the project to actively reduce the nutrient loads to the system. By ceasing the cultivation of sugarcane on site, the application of fertilizers will no longer be necessary. Reduced inputs of excessive nutrients should slow the spread of cattails and other plants with high nutrient tolerances, and should produce a slow recovery of natural vegetation patterns in some nutrient-stressed parts of the system (USACE and SFWMD, 2001). Downstream water quality is expected to improve as a result of reservoir construction.

Since mercury has been found present in the soils on-site, it is a potential water quality issue if reservoir sediments are mobilized. Care must be taken during reservoir operation to ensure that reservoir sediments are not disturbed through maintenance or recreational activities such as from boating.

2.3 Substrate

Substrate composition influences the type of habitats available to aquatic organisms. In Florida, five types of substrates commonly occur within waterbodies, sand, mud, clay, organic debris, and limestone rock (Seaman, 1985). Three of these substrates are found on the project site with limestone caprock underlying the sand and organic substrates throughout the site. Descriptions of the substrata are provided below.

It is anticipated that the reservoir and the associated seepage canals will be composed of a variety of these substrate categories depending on the excavation depths and construction techniques. The integration of multiple substrate categories into the project will serve to increase the number of available habitat types within the project area. As the number of habitats increase so too will the level of biodiversity on the site.

- Sand substrate is the most common found in Florida. Studies have shown that sand substrates result in low biological production. The low productivity of sand is due to

the nature of the substrate. However, sand mixed with silt, mud, organic debris or rock enhances productivity (Seaman, 1985).

- Organic substrates are commonly found where slow currents allow deposition. Organic debris is composed of leaf litter, decaying aquatic vegetation and other organic materials. Organic substrates are highly productive of benthic invertebrates. However, deposits of organics result in low dissolved oxygen concentrations when water flow is inadequate. A substrate of organic debris can result in biological productivity provided it is adequately oxygenated (Seaman, 1985).
- Limestone rock substrate is found on most or all of the project site. Typically, biological productivity is high where limestone is present. Limestone shoals and rubble were shown to produce greater macroinvertebrate biomass than sand or mud substrates and removal of limestone shoals has been citied as a major cause of decline in biological production. "The irregular surface features of limestone shoals and rubble provide attachment sites for algae, moss, higher plants and macroinvertebrates." In addition, some fish species prefer the habitat provided by limestone shoal and rubble to other habitat types (Seaman, 1985).

2.4 Vegetation

The introduction of species-specific vegetation would provide a seed source for the remainder of the project site, increasing the potential for natural recruitment. Plant species expected to recruit naturally in the reservoir and seepage canals include, but not limited to, facultative wet (FACW) or obligate (OBL) grass species including bushy bluestem (*Andropogon glomeratus*), sedge (*Cyperus* spp.), beakrush (*Rhyncospora* spp.), tickseed (*Coreopsis* spp.), and sand cordgrass (*Spartina bakeri*). Native plant species provide unique benefits to aquatic habitats that non-native and invasive species cannot replicate. Aquatic plants utilize solar energy to fuel the conversion of naturally occurring compounds into complex organic sugars. These sugars are then utilized by the plant in daily metabolic pathways as well as to increase biomass. Benefits of aquatic plants include nursery areas and shelter for small fish, buffer zones preventing bank erosion, food source for fish, waterfowl, and mammals, natural water purification system, nesting sites for birds, and aesthetics (FDEP, 2005a). In order to enhance aquatic habitats within the seepage canals, careful management of invasive vegetation is required.

Of concern, from a habitat diversity and enhancement perspective are the potential for nonindigenous invasive species of vegetation. Typical nonindigenous invasive species that are problematic to native habitats include water lettuce (Pistia stratiotes), alligator weed (Alternanthera philoxeroides), para grass (Urochloa mutica), hydrilla (Hydrilla verticillata), water hyacinth (Eichhornia crassipes), and wild taro (Colocasia esculenta). These species may out compete or displace native species or modify habitats, and their presence will need to be controlled to ensure that the habitat creation and enhancement objectives are attained.

3. RECREATIONAL OPPORTUNITIES

The proposed project has the potential to provide recreational resources within South Florida; however, recreational uses need to be consistent with the project goals and objectives. Potential recreational opportunities at the project site include bird watching, nature/interpretive trails, hunting, canoeing/kayaking, hiking, bank fishing, boating, and hunting. USACE and the District have stated a preference for the area being used for passive recreational opportunities such as bird watching and sightseeing are preferred over more active activities such as boating, fishing, and hunting (USACE and SFWMD, 2003). Site security and access concerns as well as water quality issues associated with nutrients and mercury contribute to these preferences.

3.1 Boating

The suitability of boating in the EAA reservoir and associated canals is dependent on water depths and the potential for water quality and wildlife. Impacts from boating activities are evident on any recreational lake and include wildlife disturbance, anchor dragging, wake disturbance of the shoreline, waste disposal, and the introduction of non-native species. Studies of the effects of boating on waterfowl have shown significant impacts. Boats can flush waterfowl resulting in reduced feeding times and depleted energy resources resulting in avoidance of prime feeding sites and decreased reproductive success. Boats also enable humans to enter remote areas such as small islands and wetlands that are essential foraging and breeding sites for waterfowl (Cywinski, 2005).

Propellers may damage sub-littoral algae or plants and mobilize sediments in shallow water. Damage caused by anchor dragging and mooring is similar to that caused by propellers, but affects deeper waters. A significant impact of motorized boats is the waste generated during operation. Waste that is produced in association with motorized boats includes debris such as fuel, oil spillage and emissions (Davies, et al., 2004). Canoe/kayaking access would allow for fewer impacts to the natural environment, and would have reduced potential for introduction of non-native plant species. The economic benefits of recreational boating have been well documented. In 2001, boating activities in Florida produced approximately $2 billion in revenues and 19,519 jobs (FWC, 2005a). So, the potential concerns associated with boating need to be balanced against the potential benefits. It is important to recognize the potential risks to water quality and habitat associated with boating activities, particularly during periods of low water levels.

Fluctuating water levels within the reservoir and the seepage canals may greatly influence the ability to boat within the system. It is anticipated that the design of the reservoir will be include a boat ramp(s) for routine maintenance of the reservoir and that the boat ramp(s) would be available to meet the public's desire for boating activities in the area. Further study of the design and the anticipated operating procedures will be needed to determine the extent of possible boating activities on the project site.

3.2 Hunting and Fishing

Hunting, bank fishing and non-motorized boat fishing activities have less impact than motorized boating, but do create the potential for reduction of native species and waste disposal issues. Over hunting and fishing is a common problem that results in a reduction of game animals and fish. Waste produced in association with recreational hunting and bank fishing includes debris such as plastics, lures, fishing line, metal hooks, spent bullets and arrows, and abandoned blinds. However, the economic benefits of hunting and fishing are considerable. In 2001 nationwide, approximately 34.1 million people fished and 13.0 million hunted. Sportspersons spent a total of $70 billion in 2001, $36 billion on fishing, $21 billion on hunting, and $14 billion on items used for both hunting and fishing (the sum of expenditures totals $71 billion due to rounding) (USFWS, 2001).

It is not anticipated that the design of the reservoir will be driven by a desire to increase hunting and or fishing opportunities. It is anticipated that wildlife will be attracted to the reservoir area by the enhanced habitat areas and the fish species will naturally populate the reservoir area, providing an inherent secondary benefit to the project. If desired, hunting and fishing can be allowed or encouraged in selected areas.

3.3 Trails and Wildlife Viewing

Recreational opportunities can be provided by the proposed project in the form of trails and wildlife viewing areas that should have low impacts to waterfowl, wildlife and fisheries. This could provide greater appreciation for the natural ecosystems of Florida and would result in few impacts to the natural community.

Nature Trails and Wildlife Viewing areas would have to be constructed along the berms of the reservoir. It is not anticipated that trails and viewing areas would be constructed along seepage canals. Various designs for nature trails and viewing areas are available. Trail and viewing area design should be compatible with the overall project objectives.

The economic benefits of wildlife recreation nationwide are significant. In 2001, it was reported that 66.1 million people participated in at least one type of wildlife-watching activity including observing, feeding, or photographing wildlife. Wildlife watchers spent $38 billion on trips, equipment, and other items (USFWS, 2001).

4. DISCUSSION

Aquatic and terrestrial habitat provided by the proposed seepage canal, reservoir, and buffer strips would provide significant benefits to the region by replacing the low-value habitat associated with what are currently agricultural areas. Establishment of native vegetation will increase and enhance aquatic and wildlife habitat and water quality.

The incorporation of boating, hunting, and fishing would benefit the local economy through selling of licenses, supplies, and equipment needed for this activity (USACE and SFWMD,

2003). In addition, it would increase recreational opportunities for local citizens and potentially attract tourists. However, the goals of the EAA may limit the feasibility of establishing the required conditions for boating, fishing, and hunting. Reservoir water depths will be regulated and managed for flood control and depending on water accessibility allowing for recreational water activities. Hiking and wildlife viewing opportunities and other passive recreational opportunities would be available regardless of water conditions.

Any recreational facilities would require public use facilities including, parking facilities, boat ramps, access roads, restrooms, sewage disposal/treatment, trash receptacles, trash collection, maintenance facilities, potable water, and Americans with Disabilities Act (ADA) compliant ramps and buildings, and staff for maintenance and patrolling (USACE and SFWMD, 2003). It is envisioned that access to the reservoir would be available from Highway 27, and the required facilities would be concentrated on that side of the project.

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